

Amendment and Response

Applicant: Gerold Gruendler et al.

Serial No.: 10/598,285

Filed: June 21, 2007

Docket No.: I431.174.101/FIN565PCT/US

Title: COOLING SYSTEM FOR DEVICES HAVING POWER SEMICONDUCTORS AND METHOD FOR COOLING THE DEVICE

IN THE CLAIMS

Please amend claims 10, 17, 18, 22, 26, and 27 as follows:

1.-9. (Cancelled)

10. (Currently Amended) A cooling system for devices comprising power semiconductor components, the power semiconductor components being arranged on printed circuit boards along with non-power type semiconductor components, the printed circuit boards arranged in plug-in contact strips of a superordinate circuit carrier, the cooling system comprising:

a cooling plate ~~which is~~ mounted in a pivotable manner, via a tilting mechanism extending from an edge of the cooling plate, ~~about~~to a tilting axis on a plug-in contact strip in a region of one of the power semiconductor components, and which can be pivoted about the tilting axis which extends parallel to the plug-in contact strip, and a cooling grid structure fitted on edges of the cooling plate and projecting in directions parallel to the plug-in contact strip;

the cooling plate having a first mounting and maintenance position pivoted away from the power semiconductor component, and a second cooling and operating position wherein the cooling plate is pressed directly onto and covers only the power semiconductor component and while the cooling grid structure does not contact or cover the power semiconductor device, but covers only the remaining non-power semiconductor components arranged on the printed circuit board adjacent to the power semiconductor component.

11. (Previously Presented) The cooling system as claimed in claim 10, comprising wherein the cooling plate has cooling fins on the cooling plate side not in contact with the power semiconductor component.

12. (Cancelled)

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13. (Cancelled)

14. (Previously Presented) The cooling system as claimed in claim 10, wherein the cooling grid structure is arranged at an upper edge side of the cooling plate and projects beyond an upper edge of the printed circuit board and into a cooling air stream.

15. (Previously Presented) The cooling system as claimed in claim 10, comprising wherein a cooling air stream device that generates a cooling air stream is arranged in such a way that it has a forced cooling parallel to the plug-in contact strips of the device to be cooled.

16. (Previously Presented) The cooling system as claimed in claim 10, wherein a cooling air stream device generates a cooling air stream which is perpendicular to the plug-in contact strips and into which the cooling grid structure projects.

17. (Currently Amended) The cooling system as claimed in claim 10, ~~comprising wherein~~ the cooling system has ~~two a second cooling plates which plate, wherein the cooling plate and the~~ a second cooling plate are positioned opposite one another and which are arranged in a pivotable manner on a plug-in contact strip in the region of a power semiconductor component components on opposite sides of a corresponding printed circuit board.

18. (Currently Amended) A power semiconductor device comprising:

at least one printed circuit board arranged in one of a plurality of plug-in contact strips of a superordinate circuit carrier and having at least one power semiconductor component positioned thereon and a plurality of other semiconductor components arranged adjacent thereto;

a cooling plate mounted in a pivotable manner, via a tilting mechanism extending from an edge of the cooling plate, ~~about~~ to a tilting axis on the plug-in contact strip in a region of the at least one of power semiconductor component and configured to be pivoted about the tilting axis via the tilting mechanism, wherein the tilting axis extends parallel to the plug-in contact strip;

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and

a cooling grid structure fitted on and extending from edges of the cooling plate, the cooling plate having a first mounting and maintenance position pivoted away from the power semiconductor component, and a second cooling and operating position wherein the cooling plate is pressed directly onto and covers only the power semiconductor component and while the cooling grid structure does not contact or cover the power semiconductor component but covers at least a portion of only the plurality of other semiconductor components.

19. (Previously Presented) The device as claimed in claim 18, comprising wherein the cooling plate has cooling fins on the cooling plate side not in contact with the power semiconductor component.

20. (Cancelled)

21. (Cancelled)

22. (Currently Amended) The device as claimed in claim 18, comprising wherein the cooling grid structure is configured at an upper edge side of the cooling plate and projects beyond an upper edge of the printed circuit board and into a cooling air stream.

23. (Previously Presented) The device as claimed in claim 18, comprising wherein a cooling air stream device that generates a cooling air stream is arranged in such a way that it has a forced cooling parallel to the plug-in contact strips of the device to be cooled.

24. (Previously Presented) The device as claimed in claim 18, comprising wherein a cooling air stream device generates a cooling air stream which is perpendicular to the plug-in contact strips and into which the cooling grid structure projects.

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25. (Previously Presented) The device as claimed in claim 18, wherein a second cooling plate is mounted in a pivotable manner on the plug-in contact strip in the region of a power semiconductor component opposite to the cooling plate and on an other side of the printed circuit board.

26. (Currently Amended) A method for cooling a device having power semiconductor components, the method comprising:

mounting pivotable cooling plates via tilting mechanisms extending from edges of the cooling plates ~~about~~ to tilting axes extending along plug-in contact strips of a superordinate circuit carrier, the cooling plates being in a mounting and maintenance position and having a cooling grid structure fitted on and extending from edges thereof;

fitting printed circuit boards into the plug-in contact strips, the printed circuit boards having at least one power semiconductor component positioned thereon and a plurality of other semiconductor components arranged adjacent thereto, wherein the cooling plates are positioned along the plug-in contact strip in regions of the power semiconductor components;

pivoting the cooling plates about the tilting axes from the mounting and maintenance position into a cooling or operating position wherein the cooling plates are held directly in contact with a corresponding power semiconductor component of a corresponding printed circuit board ~~and~~ while the cooling grid structure does not contact or cover the power semiconductor component but covers only the plurality of other semiconductor components adjacent thereto ;

orienting a device generating a cooling air stream, such that the cooling air stream flows parallel or perpendicular to the plug-in contact strips; and

providing the cooling air stream during operation of the power semiconductor components in the event of a critical temperature of the power semiconductor components being reached.

27. (Currently Amended) A cooling system for devices comprising at least one power semiconductor component, the power semiconductor component being arranged, along with a

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plurality of other semiconductor components, on a printed circuit board arranged in a plug-in contact strip of a superordinate circuit carrier, the cooling system comprising:

a cooling plate mounted in a pivotable manner, via a tilting mechanism extending from an edge of the cooling plate, ~~about~~ to a tilting axis extending along the plug-in contact strip in a region of the at least one power semiconductor component, the cooling plate having a cooling grid structure fitted on and extending from edges thereof;

means for pivoting the cooling plate about the tilting axis, which is parallel to the plug-in contact strip, between a first mounting and maintenance position wherein the cooling plate is away from the power semiconductor component, and a second cooling and operating position wherein the cooling plate is pressed directly onto the power semiconductor component while the cooling grid structure is positioned so as to not contact or cover the power semiconductor component.

28. (Previously Presented) The cooling system as claimed in claim 27, wherein the cooling plate has cooling fins on the cooling plate side not in contact with the power semiconductor component.

29. (Cancelled)

30. (Previously Presented) The cooling system of claim 10, wherein the cooling grid structure comprises metallic strips or cooling fins arranged at right angles to one another.

31. (Previously Presented) The power semiconductor device of claim 18, wherein the other semiconductor components comprise semiconductor memory components.

32. (Previously Presented) The power semiconductor device of claim 18, wherein the cooling grid structure comprises metallic strips or cooling fins arranged at right angles to one another.

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33. (Previously Presented) The cooling system of claim 27, wherein the cooling grid structure comprises metallic strips or cooling fins arranged at right angles to one another.
34. (Previously Presented) The cooling system of claim 10, wherein the tilting mechanism extends from the edge of the cooling plate and at an angle to a surface of the cooling plate which is pressed onto the power semiconductor component when the cooling plate is in the operating position.
35. (Previously Presented) The cooling system of claim 34, wherein the angle comprises a 90-degree angle.
36. (Previously Presented) The cooling system of claim 34, wherein the tilting mechanism comprises a snap action closure which snaps about the tilting axis.
37. (Previously Presented) The cooling system of claim 34, wherein the tilting mechanism comprises a snap-action hook which snaps about the tilting axis.
38. (Previously Presented) The cooling system of claim 27, wherein the means for pivoting comprises a snap-action tilting mechanism extending from an edge of the cooling plate which snaps onto and is rotatable about the tilting axis.
39. (Previously Presented) The cooling system of claim 28, wherein the tilting mechanism extends from the edge of the cooling plate and at an angle to a surface of the cooling plate which is pressed onto the power semiconductor component when the cooling plate is in the operating position.